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numbers is infinite or not. If we assume that all perfect numbers are even, we can state this problem in a still more arresting form. *Are there infinitely many primes of the form $2^n - 1$?* I find it difficult to imagine a problem more fascinating or more intricate than that. It is plain, though, that this is a question which computation can never decide, and it is very unlikely that it can ever give us any data of serious value. . . .

There is a great deal of mathematics the purport of which is quite impossible for any amateur to grasp, and which, however beautiful and important it may be, must always remain the possession of a narrow circle of experts. It is the peculiarity of the theory of numbers that much of it could be published broadcast, and would win new readers for the *Daily Mail*. The positive integers do not lie, like the logical foundations of mathematics, in the scarcely visible distance, nor in the uncomfortably tangled foreground, like the immediate data of the physical world, but at a decent middle distance, where the outlines are clear and yet some element of mystery remains. There is no one so blind that he does not see them, and no one so sharp-sighted that his vision does not fail; they stand there a continual and inevitable challenge to the curiosity of every healthy mind. I have merely directed your attention for a moment to a few of the less immediately conspicuous features of the landscape, in the hope that I may sharpen your curiosity a little, and that some may feel tempted to walk a little nearer and take a closer view.

G. H. HARDY

WHITHER?¹

I

WHETHER one enters a group of socially minded thinkers or a group of doctors in private conference or in public assembly, one soon becomes conscious of a restlessness regarding the profession of medicine. What does one think of membership in the American "Royal" College of Surgeons or Physicians, of medicine practiced under the ægis of a "group," of higher education for nurses, of chiropractors,

of Christian Scientists, of medical societies going to the public with their wares? Is the patient still the doctor's, or does he belong to a hospital? Should "industrial" medicine be developed? Should hospitals be standardized? Should the medical educational requirements of six years be lengthened to seven or eight or nine? Where ought one to stand on "state" medicine; should medicine have a portfolio in the cabinet; should clinical teachers be forbidden private practice? Should hospitals be open only to staffs or to all licentiates in medicine?

Are the answers to these problems really hard to find?

The medical profession has been caught in the swirl of the times. In the press of the moment it has forgotten its origins. Lost sight of are the circumstances, the principles and the ideas which in all times have made medicine what it is. Cause and effect are being mixed up. The present day shows too much of the form and too little of the spirit of that which has given the doctor his place and power.

II

It is no new discovery that the tyranny of a crowd is no better than the tyranny of an individual and that both lead to death. In spite of our cry that we are democratic we are almost exactly the reverse. We certainly dress alike; it has been said that we look alike; the corollary is that we think alike. Tersely put, we work in crowds and think in gangs and when applied to medicine we forget why anything smacking of such forms has prospered.

A case in point is offered by the diagnostic and operating "groups" in medicine which to-day infest us. Blinded by the success of one or two prototypes, medical men have concluded that their form accounts for their popularity. The fact is that none such has prospered—save as any business which is not bankrupt may be said to be prospering—except as the old substance of medical practice has been kept alive in the group by one or two dominating personalities. Without such vital souls there is left only a paper organization—all, it is safe to predict, that will survive when the present day medical or surgical leaders of these groups are gone.

¹ Remarks made at the banquet of the Ohio State Medical Association meeting, May 3, 1922.

A second case is offered by the specialists. Men formerly were driven into specialisms through professional or popular demand. A doctor peculiarly skillful of hand or mind had his day filled for him by those insistent that he do continuously the thing in which he excelled. The present day specialist is a self-anointed soul. He knows that to have a large view in medicine means hard work and broken hours; he sees an "opening" for a specialist, spends six weeks learning the necessary tricks and succumbs to the easiest way. It will be answered that specialists are needed to do the complicated things of blood analysis, bacteriological study and X-ray investigation. The truth is that these newer things have not become additions, as they should be, to the older and established methods of diagnosis and treatment but lazy-man substitutes for them—and poor ones. In the main, these "scientific" methods have not decreased error in diagnosis or broadened treatment. Chemical methods of blood analysis have not enlarged our knowledge of kidney disease; failures to obtain positive bacteriological findings have permitted patients to go without a diagnosis where an older generation of doctors would have judged correctly the nature of the disease from its signs and symptoms; while the ease of looking through a patient with X-rays has dulled the touch, the sight, the hearing and the judgment which made great our predecessors.

It is the common thing for our patients to be sent to a laboratory man, an X-ray specialist, a nose and throat surgeon, a skin doctor and a half dozen different types of special surgeons. It has even been proposed that we need a specialist to determine what medicine shall be given. But those engaged in these types of practice are beginning to realize its dangers. The dangers are to be met with another specialist—one who is to gather together the findings of all the doctors and tell the patient what he came a-seeking. He is to be known as an integrator. I sent an article proposing this scheme to a friend of mine with the marginal note that our colleagues were beginning to look for doctors once more.

I know a place where one can serve himself to a diagnosis as one serves himself to a meal

in a cafeteria. One starts with a numbered card and buys himself at different counters and from different men a general examination, an investigation of the throat, an X-ray plate of the gall bladder, a dental overhauling, a surgical operation and a plaster cast for the foot. Each item carries its price which is punched on the ticket. What the scheme takes no account of is that the patient does not care whether he has Hirschsprung's disease, erythema nodosum or pseudo-hypertrophic muscular atrophy. What he is after is a plain statement of what is the matter with him, and whether he can be "cured" or not; also there is wanted a little appreciation of his state of mind and some understanding of the economic hardships of his family in the interim of being ill. The food counters do not carry these dishes.

It is a sin against the Holy Ghost to say that the profession is overorganized, but such it is. Organization springs from the desire of minorities to live in spite of majorities. As such, organizations give life, shelter and fellowship to the threatened and despised of the world. Their purposes accomplished, they tend toward reaction so that rarely have they merit after birth, when their powers of leadership because of rightness of cause, are supplanted by the powers of organization to impress their will. What looks like strength is merely a cramp—medically expressed, the cramp of death. Once "successful," Chapman's charge is correct: "All association, business or social, literary or artistic, religious or scientific, is opposed to any disrupting idea." How much in medicine the individual cowers to-day in the shadows of this mass mediocrity is innocently portrayed in a recent volume on civilization in the United States. Of thirty men who write freely of our politics, art and religion the one who speaks for medicine must "for obvious reasons" remain anonymous.

This is just a reversed way of saying that the present day doctor has sacrificed his individuality—the thing through which alone he has gained his public standing historically or in the present. Never before has he affected a community through mass action, and it is safe to predict that through such he never—last-

ingly—will. He enters the public's life through an individual's need of him; and in the crises of life—birth, fear, despair and death. Disease may be objective but its effects are all subjective. Through his understanding of the individual in these circumstances has come the reward of individual trust; and it is this confidence multiplied which constitutes the public esteem in which the doctor lives. To think that such can be built up through massed professional activity is idle.

When will we get a secretary of medicine in the cabinet? Never through a lobby but when someone politically powerful transposes the personal faith he feels in his body physician into political action. We may get him any day that an occupant of the White House trusts adequately the mind and heart of his doctor. This is the manner of men. Not so long ago another follower of the "regular" school asked me why one of our intelligent citizens threw his whole energies into the cause of homeopathy. I ventured the easy answer that his family doctor was homeopathist, and more—that as a man this doctor was no mean personality.

III

If the medical profession has problems it is because it has either voluntarily relinquished what it should have held or done badly what others have done better. Each of these headings has subheadings of a legitimate and an illegitimate type. The picture of my old doctor friend jogging along in his buggy in the hours after midnight, responsive to a charity call registered through a telephone which he had himself installed in the home of his patient is all too rare. I inquired why he had not sent his younger colleague. He answered that he could not ask an assistant to rise in the night and work without material recompense. The young doctors do not nowadays follow the sick poor of our hospitals to their homes. The social service workers do this and the human aspects of the problems of disease are to-day more commonly touched by the educated nurse than by medicine's new generation. But if these things be so, is it any wonder that the sum total of patients which constitutes our public is becoming increasingly deaf to sugges-

tions which spring from the medical profession and increasingly responsive to those emanating from social uplifters or economic and political reformers?

I venture to add that we do not know enough. For more than a decade now the non-medical psychologists have been able to tell us more of the rank of our mental defectives than we ourselves knew; the graduates of domestic science schools have known more of food values than ninety-nine of a hundred doctors; and laboratory technicians in X-ray work and the simplest biochemical tests have become the interpreters to the profession of the things which it should know itself. If the medical man still feels that *he* is set apart to teach these things, he must be securer in his knowledge of the fundamentals.

From an illegitimate side, the doctor's calling has been placed in parallel with the caricatures and fragments of medical thought represented in Christian Science, osteopathy and chiropractice. There has been much scramble to keep these things in their proper places through the political seesawing of legislative groups inclined to listen at one time to the doctors and at another to the toredoes. The answer should be simple. Why does the doctor ever acknowledge these as competitors? Have they a better knowledge of the principles of medicine and surgery? Or need there be envy that chicanery so often pays better than honesty? It will be argued that the public does not know enough and that it must be protected. This has been the cry of autoocrats since the stork ruled the frogs. What is at stake is the question of our fundamental faith in democracy. In brutal terms, our average fourteen-year-old intelligence is asked to decide whether it will learn or die. For myself, I have little faith in the moral or mental merits of a people which in law buttress the one with the virtue of jails and the other by a superimposed intelligence. The superiority of a people is to be measured by its ability to withstand temptation and not by the number of its prohibitory laws which makes a going-wrong impossible; nor is its superiority proclaimed by an absence of quack solutions but by its clearness of intellect which permits it to distinguish these from better ones.

Why the forcing of more health laws upon an unwilling humanity? Those who do not believe in vaccination, antitoxins and the purification of water and food supplies might, for a change, be permitted to die. If our Christianity needs to be invoked let us consider St. Luke. As physician and teacher he preached that "Now is salvation come nigh unto you." But with the truth uttered he left his audiences to make the final choice.

The medical profession will increase or lose its public power only as the collective expression of the people's faith in the individual doctors who touch them. To breed such faith the doctor must get again his old courage and cease to be the pussyfooter of our present day. What is wanted is not a strutting vanity, common enough, but a consciousness in the doctor of where he came from and where he is going. To do this he needs to learn again that he is a judge and obligated as such to get at evidence first hand. The profession of medicine is an openhanded one whose discoveries, practice and points of view are free and obtainable for the asking. Let the medical man then choose well whom he will visit and learn from. Let him discover what men actually do and not what others tell him they do. This holds true also for the evidence which he gathers from the printed page. In the hustle of our modern life the medical man has here fallen into the group of the common. He does not read originals any more and hardly reviews. The thing has become so attenuated that in his journals and text-books he is literally consuming reviews of reviews of reviews. As well may a man think to understand the psychology of sheep because he feeds on lamb stew.

The fundamental situation will not be changed in the space of a night. New viewpoints and idealism grow best in young soil. Whence our interest in the education of the new doctor. But medical education like all so-called university education has fallen into bad ways. There have been carried into it the false ideals of the kindergarten and grammar school. Education is conceived of, too much, as something that may be bought for and added to a son. And the present day university course does cost only four years and four

thousand dollars of anybody's money. This idea must change. If there is a fundamental law under which we live it is that of Lamarck. Not through environment but through the degree of reaction on our part to that environment do we develop or atrophy.

But what is there in modern university education which develops the senses to observation, the mind to logic and the soul to understanding? The medical student is to-day lectured into coma—but the skill we are seeking can be acquired only by doing. Whence will come the man and the institution to teach again by the apprentice system? When will we see again, working students emulating masters?

What is so badly started in the universities and medical schools continues in the subsequent professional life. There is an eternal clamor for positions on hospital staffs, on boards of control, on faculties of medicine. As in political parties, groups of doctors are insiders or outsiders. What does it all matter and when will it be learned again that only the man counts and not the circumstance? Staff jobs, faculty places and positions of power are the husks of corn. Men collect jobs like political badges, recognizing in all too few instances that they are nothing but opportunities for work—and who uses them?

A doctor friend told me recently that he felt cramped in a hospital which housed only eight hundred beds. But Boerhaave changed all European medicine with but twelve; Corrigan rewrote the chapter on heart disease with but six and Külz whose work fills one third of all the tomes on diabetes had just two patients. Could any practitioner have less?

IV

Our modern medicine is tending in two directions, the one leading toward the ideals of the five-and-ten-cent store and administrative madness. This group talks of "selling" its ideas to the public. The other is recognizing that the collective skill and power and position of the medical group is only a composite of the piled-together abilities of the individual doctor and the reaction evoked from the individual patient. Our time represents a call to return to the fathers. The world is seeking, as of old,

doctors with a kindness, a tolerance and large understanding, the skill of hand, the skill of mind and the resourcefulness of a past generation. Where are the successors of van Swieten, John Hunter and Benjamin Rush or, in more modern terms, of Neusser, Osler and Billings? The Greek world sank as it grew in democratic principle—not in the abstract principle of democracy but in the concrete expression of it which substituted for its earlier rulers, proficient in the arts and sciences, the ever increasing number of non-productive Athenian traders. Is the efficiency of modern medical practice riding to a similar fall? Let us be honest with ourselves. If medicine fails it can not be ascribed to our stars, for our time, as all ages before it, in the hour of sickness and death cries as did Jeremiah: "Is there no balm in Gilead; is there no physician there?"

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ALEXANDER SMITH

FROM Edinburgh, Scotland, his birthplace, comes the news of the death of Professor Alexander Smith, lately head of the chemistry department at Columbia University. While this termination of the long and insidious illness which clouded his latter days was not unexpected, his loss is a heavy one for chemistry.

His circle of influence was perhaps widest as a text-book writer. Someone has remarked that a pre-eminent elementary text-book in any science appears but once in a generation. In his generation, Alexander Smith's elementary text-books have been the pre-eminent ones in this country, and, in their various foreign translations, have become well known abroad. When Smith was president of the American Chemical Society in 1911, an after-dinner speaker referred in his remarks to Smith's clear and sparkling eye, which, as those who knew him will recollect, was a very conspicuous and characteristic feature of his. Now, the same two epithets, clear and sparkling, might very properly be applied to his text-books in part explanation of their unrivaled position in the text-book field.

Smith's teaching work in this country was begun at Wabash College, whence, in 1894, he went to Chicago, at which place his teaching methods were chiefly developed. He was intensely active here also in administrative work both within, and, as dean of the junior college of science, beyond his own department; but had still abundant energy in reserve to continue investigative work. The researches on sulfur and on vapor pressures, for which, in 1912, he was awarded the Keith Prize by the Royal Society of Edinburgh, will recur to the minds of most chemists. In 1911 he migrated to Columbia University as head of the department of chemistry, which he proceeded to reorganize very fundamentally, energizing progress with his overflowing vitality until forced by illness to desist.

Truly, his spark was a brilliant one, but all too short-lived.

ALAN W. C. MENZIES

SCIENTIFIC EVENTS

THE COST OF RESEARCH WORK

THE report of the British Scientific and Industrial Research Department for the year which ended on July 31 last has been published. According to an abstract in the London *Times*, it is divided into two sections, the first, which is signed by Lord Balfour, being the report of the committee of the Privy Council for Scientific and Industrial Research, and the second, signed by the administrative chairman, Sir William S. McCormick, that of the Advisory Council.

The first section is largely concerned with financial detail. The total expenditure of the department during the financial year was £525,584, made up of £273,193 from the Exchequer, £65,358 interest on the capital fund of one million for the formation of research associations, £86,355 from the same fund, and £100,677 from fees for tests and special investigations carried out for outside bodies, from the contributions of the shipbuilding industry for research in the Froude tank, and from repayments by the fighting services for research undertaken directly for them. Deducting the last item and also the grants from the million capital fund, the actual net expenditure of the